VOL. 2 NO. 9 September 1985

COMPUTER DIGEST

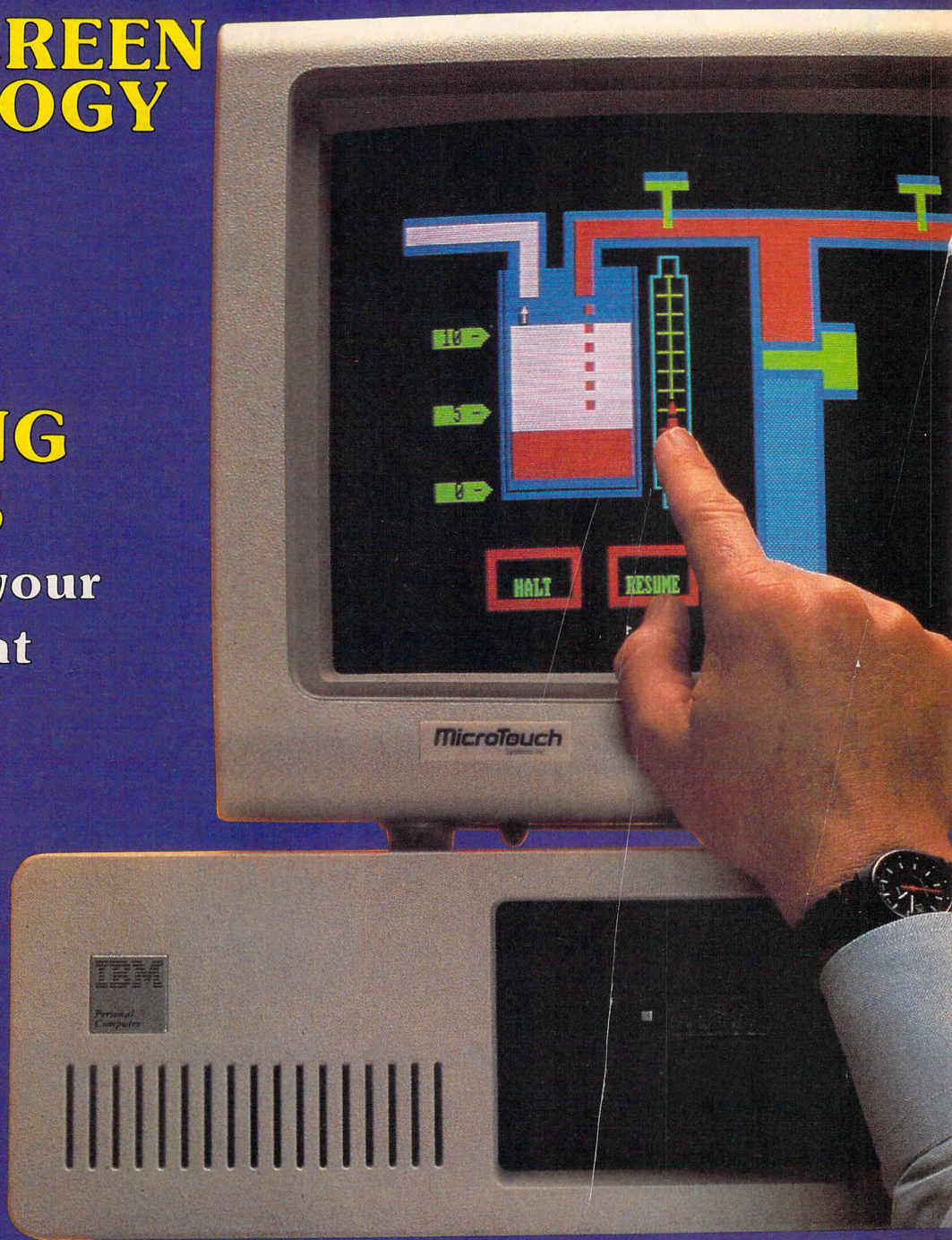
NEW KIND OF MAGAZINE FOR ELECTRONICS PROFESSIONALS

TOUCHSCREEN TECHNOLOGY

Inputting the easy way.

EMULATING PRINTERS

How to make your printer do what you want.

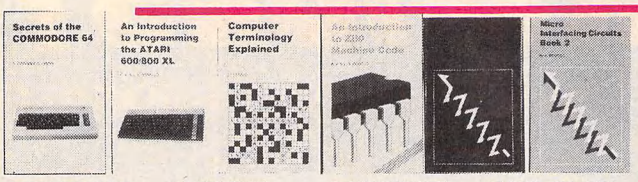


A GERNSBACK PUBLICATION

VOICE REPRODUCTION FOR YOUR TIMEX

More than 5 seconds of speech with 16K.

Electronics Paperback Books


Secrets of the COMMODORE 64
An Introduction to Programming the ATARI 600/800 XL
Computer Terminology Explained
An Introduction to Z80 Machine Code
Micro Interfacing Circuits Book 2

☐ **SECRETS OF THE COMMODORE 64. ..... $5.00.** Masses of useful info and programming tips not found in any user's manual.

☐ **INTRO TO PROGRAMMING THE ATARI 600/800 XL ..... $5.00.** Perfect complement to the Atari user's manual. Even shows how to use animated graphics.

☐ **COMPUTER TECHNOLOGY EXPLAINED ..... $5.00.** Explanations for computer terms often encountered. A dictionary for computer lingo.

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☐ **MICRO INTERFACING CIRCUITS—BOOK 1 ..... $5.00.** Practical add-ons transform your computer into control or measurement equipment.

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How to Design Electronic Projects
How to Get Your Electronic Projects Working
How to Design and Make Your Own PCBs
Electronic Science Projects
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☐ **HOW TO GET YOUR ELECTRONIC PROJECTS WORKING ..... $5.00.** How to find the faults in your projects, repair them and get them working.

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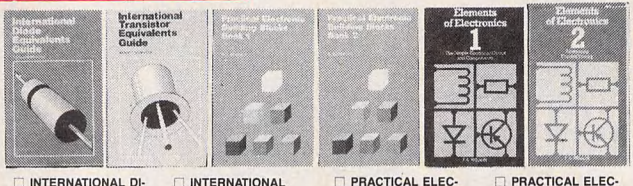
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International Transistor Equivalents Guide
Elements of Electronics 1
Elements of Electronics 2

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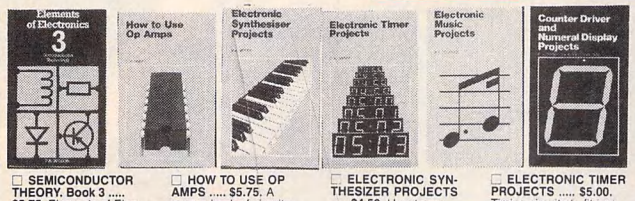
Elements of Electronics 3
How to Use Op Amps
Electronic Synthesizer Projects
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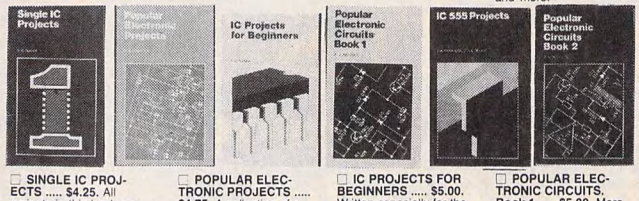

☐ **SINGLE IC PROJECTS ..... $4.25.** All projects in this book are based on one IC and are simple to construct. Great way to get started with IC's.

☐ **POPULAR ELECTRONIC PROJECTS ..... $4.75.** A collection of a wide range of electronic projects and circuits for the experimenter.

☐ **IC PROJECTS FOR BEGINNERS ..... $5.00.** Written especially for the less experienced experimenter. Complete parts layouts and wiring diagrams.

☐ **555 PROJECTS ..... $5.00.** So useful that this IC has an unparalleled reputation. Here's a book full of useful applications.

☐ **POPULAR ELECTRONIC CIRCUITS. Book 1 ..... $5.00.** More circuits for hobbyists. Audio, radio, test, music, household and more.

☐ **POPULAR ELECTRONIC CIRCUITS. Book 2 ..... $5.75.** More useful circuits. None of these projects duplicate those in Book 1 of this series.

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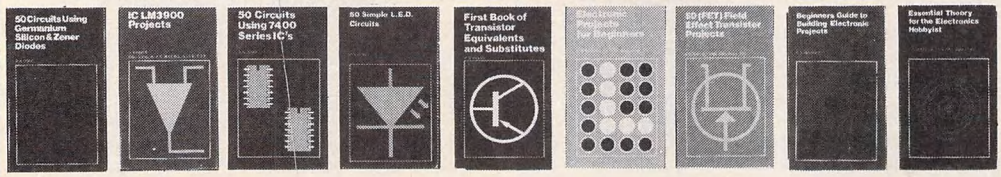
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IC LM3900 Projects
50 Circuits Using 7400 Series IC's
50 Simple L.E.D. Circuits
First Book of Transistor Equivalents and Substitutes
50 FET Field Effect Transistor Projects
Beginners Guide to Building Electronic Projects
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You can add more than five seconds of speech to your Timex-Sinclair 1000. **Jason M. Kinser**

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Here's the quick-and-easy way to make your printer do the things you want it to. **Herb Friedman**

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"Compatibility" is the big sales word these days, but exactly *what* does that word mean?

5 Letters

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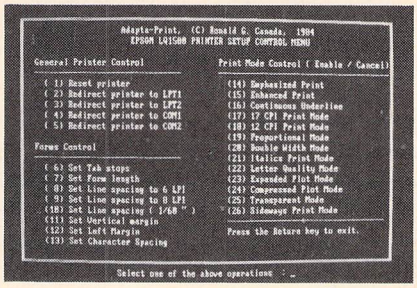
"TYPITALL" is a word processing software system that does it all and is easy to learn.


Adapta-Print. (C) Ronald G. Canada. 1984
EPSON LQ1500 PRINTER SETUP CONTROL MENU
General Printer Control
(1) Reset printer
(2) Redirect printer to LPT1
(3) Redirect printer to LPT2
(4) Redirect printer to COM1
(5) Redirect printer to COM2
Forms Control
(6) Set Tab stops
(7) Set Form length
(8) Set Line spacing to 6 LPI
(9) Set Line spacing to 8 LPI
(10) Set Line spacing (1/60 ")
(11) Set Vertical margin
(12) Set Left Margin
(13) Set Character Spacing
Print Mode Control (Enable / Cancel)
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(15) Enhanced Print
(16) Continuous Underline
(17) 17 CPI Print Mode
(18) 12 CPI Print Mode
(19) Proportional Mode
(20) Double Width Mode
(21) Italics Print Mode
(22) Letter Quality Mode
(23) Expanded Plot Mode
(24) Compressed Plot Mode
(25) Transparent Mode
(26) Sidemargin Print Mode
Press the Return key to exit.
Select one of the above operations : _

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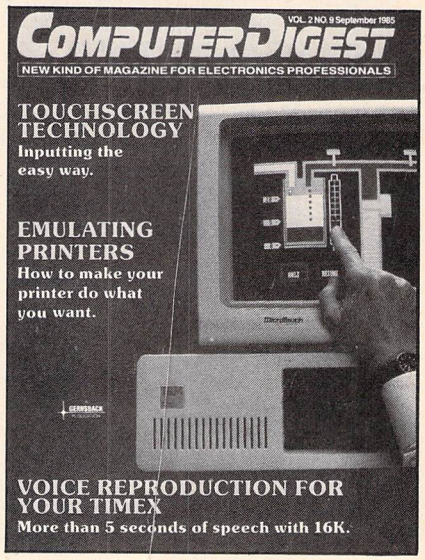
ON THE COVER

The new, lower-cost MicroTouch Screen™ employs technology to offer a combination of durability, optical clarity and high resolution not previously attainable to touch screen users. The screen, just announced by MicroTouch Systems, Inc., features a solid glass overlay sensor with a resistive coating bonded to its surface. See page 8.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VOICE REPRODUCTION FOR YOUR TIMEX
More than 5 seconds of speech with 16K.

COMING NEXT MONTH

Build A Firmware Card
It allows you to place a 2K or 4K EPROM anyplace in the USR memory of your Timex/Sinclair 1000.

Protecting Your Electronic Equipment
How to use MOV's (*M*etal *O*xide *V*aristors) to protect against surges.

Computer Aided Design
Using your computer to help prepare schematics or other diagrams and flow charts.

EDITORIAL

Incompatibility.

■"My wife and I were incompatible," the old joke goes—"I didn't have enough income and she wasn't patable."

Be that as it may, the computer manufacturers *know* that certain words are necessary if you're going to sell a computer in today's marketplace. "User friendly" is one of the phrases that people look for.

Well, of course. You wouldn't buy an unfriendly computer, would you? And if the manufacturer didn't specifically say it WAS friendly, chances are that there was sufficient reason for that.

"Free" has always been a good sales tool, too. Offer something for nothing, and you may well be on the road to making a sale. "Free" can be anything from a truckload of software that the user may never have any use for, to an accessory or peripheral that he wouldn't know *how* to use. It doesn't really matter, as long as it's "free."

But what we're *really* going to jump on here, is the recent plethora of advertisements that boast "IBM Compatible." In fact, just about the *only* company that does not use this phrase in their advertising, is IBM itself!

What does "IBM Compatible" mean?

If you try to run a piece of IBM software in a foreign computer and the computer doesn't explode in protest, I suppose that's sufficient reason to call it compatible. Maybe so. But compatibility can come in varying degrees. And *how* compatible the computer you plan to purchase may be is more important than the mere fact that it is at all compatible. Compatibility, by my own measure, is the ability of my computer to run—with no modification—IBM software, and, in turn, allow me to run my own programs on the office IBM machine. Now *that's* compatibility.

Anything else is advertising.

It's the old story. *Caveat emptor* means "let the buyer beware." So the next time the salesman says "IBM Compatible," ask him exactly what he means. You just might get some very funny answers.

Byron G. Wels

Byron G. Wels
Editor

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LETTERS

18-Wheel Data Base

I work as a truck driver, and recently pulled into a computerized warehouse. The dispatcher pushed a card into a slot and the next thing I knew, my load was ready, the bill of lading was typed out, and I was almost on my way before I had time for a cup of coffee! On the way I got thinking about it. What would happen if the computer made a mistake? And is it going to be putting warehousemen out of their jobs? Where will it all stop?—Billy Horst, Clifton, NJ.

Don't panic. We're a long way from a computerized truck driver.

Warran-Tease

How can I take advantage of some of the tempting construction projects if my computer is still under warranty? Is there a way the manufacturer can tell if I opened the cabinet?—Jack Wilton, Cambridge, MA.

Yes Jack, there is. Check carefully and you might find a special paper patch cemented over one of the mounting screws, or even a drop of paint. Try to remove that screw and you break the "seal" revealing that you tampered with the unit. The best and safest bet is to wait until the warranty expires.

Wants To Learn

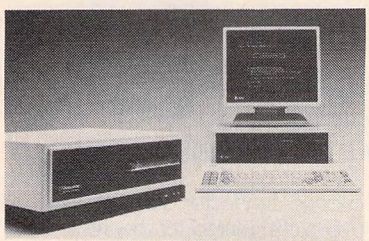
I recently purchased a computer, primarily for use in word processing. I agree with you completely that there is no need to learn to program, as you can buy better software than you could possibly write. But I can see several areas where I would have modified—the commercially-available programs I'm now using. I've tried several books, but they seem too advanced for me.—Fred Sandors, Omaha, Neb.

Fred, try a local Adult Education class in BASIC Programming. There's nothing like having a "live" instructor to answer questions.

COMPUTER PRODUCTS

For more details use the free information card inside the back cover

TAPE BACKUP, the *Mountain 6300 combo* is completely compatible with the AT&T *PC 6300* running under the MS™-DOS 2.11 operating system. The hard disk is cable-connected to the AT&T *PC 6300*'s hard disk controller. Cabling is provided that allows the combo's disk to be connected either alone, or in addition to, the AT&T *PC 6300*'s internal disk.



CIRCLE 21 ON FREE INFORMATION CARD

The *Mountain 6300 combo* backs up 3.4MB per minute, with full error correction, and without using deferred writes, which could mean a loss of data during a power glitch. The tape-backup menu requires that you need only enter a "B" for backup, and walk away with the assurance that all your files will be quickly and accurately backed up. There's no need for the user to get involved in management of the files being transferred, no rewinding, no track addressing, etc.

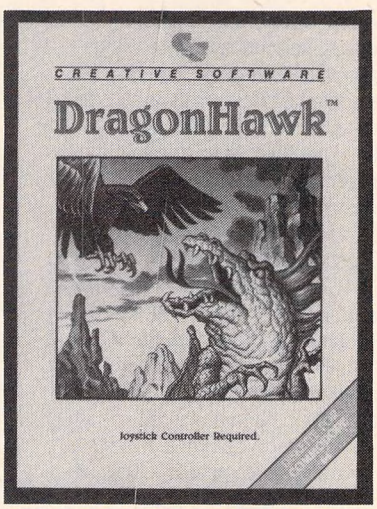
Restoring tape backup data to disk is also easy. The user can restore the entire disk at the same speed used to back up, or can choose to restore only a single file, or group of files by date of creation, or all files in a subdirectory, or any combination of the above.

The *Mountain 6300 combo* is priced at $5,595.00.—*Mountain Computer, Inc.,* 300 El Pueblo Road, Scotts Valley, CA.

EDUCATIONAL GAME, *DragonHawk,* is a disk-based adventure-strategy game.

The player controls *DragonHawk.* The mission is to kill a flying serpent that has put a full mountain range of creatures under its spell. Flying iguanas, phoenix birds, dragon puppies, bats, and mosquitos try to keep *DragonHawk* from gaining access to the flying serpent's airspace. *DragonHawk* destroys them by pouncing on them from above. However, if he stays at one level too long, he will also have to battle a violent lightning storm.

DragonHawk has as many lives as he has feathers, which are indicated by a feather-counter at the top of the screen. When all the creatures have been eliminated, *DragonHawk* faces the flying serpent itself. The fire-breathing serpent chases *DragonHawk*



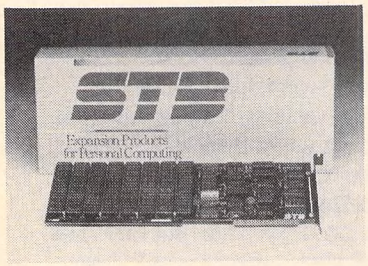
CIRCLE 22 ON FREE INFORMATION CARD

all over mountains and skies until the serpent's weak spot is discovered and it is destroyed. The player must discover that weak spot.

DragonHawk is priced at $29.95.—*Creative Software,* 230 East Caribbean Drive, Sunnyvale, CA 94089.

EXPANSION BOARDS, the *Memory Companion/PC,* are designed for use with the Lotus/Intel Expanded Memory Specification; they are add-ons that provide the additional memory necessary for using the specification.

The new expanded memory specification (up to 8M) allows software to address RAM in excess of the standard 640K. The *Memory Companion/PC*

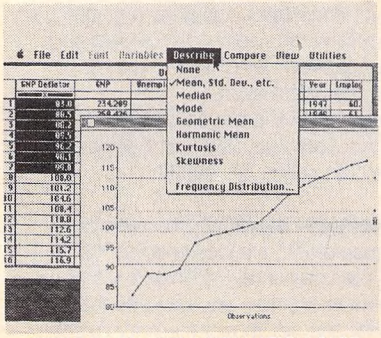


CIRCLE 23 ON FREE INFORMATION CARD

provides IBM PC/XTs™ (and compatibles) with up to 2M of additional memory. The board is compatible with Symphony ™ 1.1, and up to four *Memory Companion/PC's* may be installed in a system, increasing the memory to 8M. The 64K *Memory Companion/PC* is priced at $349.00; the 256K version sells for $395.00.—*STB Systems, Inc.,* 601 N. Glenville, Suite 125, Richardson, TX 75081.

STATISTICS PACKAGE, *StatView,* is an interactive statistics program for the Macintosh computer. It is designed for data analysis by people who work with numbers: economists, scientists, students, accountants, actuaries, sociologists, researchers, marketing executives, securities analysts, legislators, political campaign managers, and all other professionals who analyze data. It is a visual data-analysis package that takes advantage of the Macintosh computer's windows, pull-down menus, and mouse.

StatView is designed for use on all Macintosh formats, including 128K and 512K Macintoshes and the 1-Megabyte LISA equipped with Mac Works, the Macintosh emulation disk. *StatView* permits window-scrolling, changes in column width, and choice of font and font-size for data in a window -- small for viewing many columns and rows, or for ease of reading. Cut, copy, or paste operations can be done between applications.



CIRCLE 24 ON FREE INFORMATION CARD

StatView is priced at $199.95.—*Brainpower, Inc.,* 24009 Ventura Blvd., Calabasas, CA 91302.

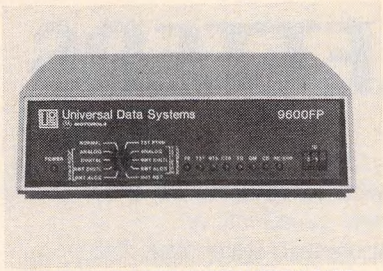
MEDIA SAFE, the Sentry Supreme, model *5750* keeps its contents cooler than conventional fire-rated safes that are used for storing paper documents. At 1700°F, the interior of the Sentry Supreme remains below 97°F, and the relative humidity below 80%, levels well below U.L. standards for safe media storage. The safe is also large enough to protect not only diskettes and tapes, but a variety of non-electronics valuables, such as microfiche, photographs, stamp collections, and documents. The safe is tested and classified by Underwriters Laboratories to protect the contents of both storage compartments at temperatures up to 1700°F for one hour.

CIRCLE 25 ON FREE INFORMATION CARD

The Sentry Supreme model *5750* has a retail price of approximately $600.00. The larger model *5760* is priced at approximately $750.00.—*John D. Brush & Co., Inc.,* 900 Linden Avenue, Rochester, NY 14625.

FAST POLL MODEM, the model *9600 FP,* is a fast-training 9600 bps modem designed for use on multipoint networks. The design combines LSI and microprocessor technologies that result in high reliability and low power consumption. Fully automatic adaptive line equalization allows 4-wire full duplex private line operation over 3002 unconditioned leased lines without manual strapping. The digital adaptive equalizer compensates for the effects of delay and amplitude distortion that would otherwise cause intersymbol interference in the received signal. The model *9600 FP* features an 8 ms RTS-CTS delay for fast turnaround time.

Also featured is a fallback mode,

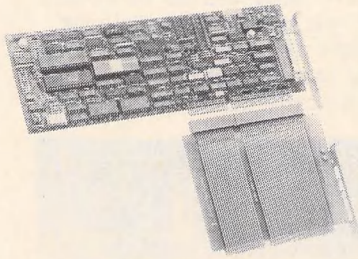


CIRCLE 26 ON FREE INFORMATION CARD

which allows the user to change the data rate to 4800 or 7200 bps. Mixed-rate network operation allows independent or tributary modems to transmit to the Host modem at 9600, 7200, or 4800 bps. The model *9600 FP* comes equipped with diagnostics for isolating problems in the data-communications path. Built-in test features include local digital loopback, remote activated digital loopback, local analog loopback, remote activated analog loopback, and 511 test pattern generation/checking.

The model *9600FP* is priced at $1995.00.—*Universal Data Systems,* 5000 Bradford Drive, Huntsville, AL 35805-1953.

EXTENDER BOARD, the model *3690-26,* is designed for personal computers, and not only allows in-circuit probing of functional boards but also provides convenient marked test-points for all 98 bus lines on both card connectors. The extender includes a heavy-duty bracket to support cards while troubleshooting.



CIRCLE 27 ON FREE INFORMATION CARD

Card-edge-connector contacts are gold-over-nickel plated for low resistance and minimum wear. Receptacle contacts have gold inlays in copper-nickel alloy bifurcated fingers. Bus-line current-ratings are 5 amps with 200-volts RMS or 300-volts DC ratings. The bus lines are protected by a solder mask to prevent inadvertent short circuits while probing, making it ideal for experimenters.

In 1-4 piece quantities, the model *3690-26* extender cards are priced at $45.13 each.—*Vector Electronic Company,* 12460 Gladstone Avenue, Sylmar, CA 91342.◀CD▶

SOFTWARE REVIEW

TYPITALL for word processing

■At last count there were more than 1000 word processor software packages. Unfortunately, some are so difficult to use that just digesting the instruction manual takes several evenings. A really good high-performance word processor should require no longer than an hour or so to learn, be easy to use, and almost never require reference to the documentation. While this kind of word processing software is rare, it does exist, as TYPITALL for the Radio Shack Model 4.

TYPITALL is generally unknown because it is the "Plain Jane" of word processing, having no cute screen displays, menus or individualized function help commands to get in their own way. The program is document oriented, meaning it prepares and saves complete documents, not pages or sections which are later assembled into a document during printing. TYPITALL is specifically designed to simplify *boilerplate* by saving and tagging as files or blocks bits and pieces of text that will eventually be incorporated into a larger document. In addition to unusual editing functions, TYPITALL has most of the conventional word processing features except for a conventional mail-merge. Instead, it substitutes instantaneous keyboard entry while printing.

Response to all functions except for saving and reading disk "inserts" is instantaneous because no disk overlays are used. Unlike most modern word processors which use disk overlays for routine functions, all of TYPITALL's features including printer commands reside in memory along with the document, and all functions are *command driven*, providing instantaneous response to any command. For example, to completely reformat a document or to skip from the beginning to the end of a 6000 character file takes about a half-second. To reformat or skip to the end of a 25,000 character (4000 word) file takes less than 2 seconds.

Disk overlays are used only for (1) The help screens; (2) Hyphenation—which is done when the entire document is complete and ready for printing; (3) An optional integrated spelling checker; (4) customizing of the program. Somewhat unusual, either temporary or permanent customizing can be done on-the-fly by leaving the program, making the changes, and then returning to exactly where you left off.)

TYPITALL requires a TRS-80 Model 4 computer with one or more disk drives and any commonly-used operating system such as Radio Shack's own TRSDOS 6 or the aftermarket DOSPLUS IV. (A somewhat similar version of Typitall 2 for the Model I and III computers will run under any DOS, including NEWDOS.) The program requires about 15K of RAM, leaving 33K for the document. There is no computer lockup if the full RAM is used since a full or partial dump to disk can be made because the program does not require additional memory to call in a disk overlay. Similarly, if a disk is full the user can install a disk in any drive and instantly save to the disk. If something causes the computer to hang (which is unlikely), a full reset of the computer and reenter of TYPITALL will come up with the document in the condition it was in just prior to whatever caused the problem. Short of turning the computer off, it is essentially impossible to accidentally lose an active document.

Because the program is document oriented the editing commands process complete sentence elements. In addition to conventional overwrite and insert, with a single command the user can delete or exchange words, sentences, or paragraphs with the previous sentence element, or randomly exchange blocks or pages throughout the document, or delete pages or any marked portion of the document. An on-the-fly *line insert* mode splits the screen so an insert can be viewed independently of what was written earlier, and the line can be independently edited. Touching a key instantly closes up the line and reformats the entire paragraph if the line insertion is more or less than a full line length. Any change to anything anywhere in the document automatically reformats text until the next end-of-paragraph marker or carriage return. Although TYPITALL is superfast in handling text, its speed requires extra care when deleting anything because the program has neither a paste nor a holding buffer: a deletion is gone forever—there is no recovery.

Boilerplate is under complete control of the user, not the program. Unlimited blocks with conventional filenames or labels A through Z can be marked and saved as either marked blocks or text blocks. Saved text blocks are handled by the program as conventional text or document files, and can be called back and inserted at the cursor position, chained in serial order, or chained to the end of the file. A labeled block is inserted into the text along with its label, leaving it premarked for easy relocation.

Although the screen can show the text as it will be printed on a line-by-line basis, the display isn't "what you see is what you get." If the screen width is the same as the printing width the display will show the proper words per line, but only left justified, like a standard typewritten page.

Except for an *undelete*, TYPITALL can do almost anything, and do it better than most word processors. If it was available for computers other than than the Radio Shack Model 4 there's a good chance that, like WordStar, it would be a legend in its own time.

TYPITALL, Howe Software, 14 Lexington Rd., New City, NY 10956. For Radio Shack Model 4 with one or two disk drives.◀◍▶

TOUCHSCREEN TECHNOLOGY

Touchscreen technology can vastly simplify computing.

MARC STERN

■How many times have you heard it said that computers will make your life easier, only to turn around, fire up a microcomputer and have your day go anything but smoothly? If you're like any computer user, you're probably thinking about all the contortions you have to go through to do a simple task.

Just look at telecommunications. You want to dial a number and transfer data or communicate with a second party. You turn on the computer; find your telecommunications program; start the disk operating system; load the program into memory, just to get set. You've just achieved step one. Step two requires you to have the program originate the call; dial the number and connect to the remote system. Somewhere in there—at some time—you also had to set the program up so it would work correctly with the person you are trying to contact.

The same is true of any function in the microcomputer world. Microcomputers are powerful beasties, waiting to do your bidding. Getting that bidding done can take some doing on your part.

Let's say you are using a program which requires you to continually input information from the keyboard. You answer a series of questions which appear on the screen. These may be leading to a relatively simple conclusion, such as setting your microcomputer's printer port; communications port, or clock. Along the way, you must continually hit various keys to answer the questions and then wait until the program updates the microcomputer. As you work with the system, you think there must be a better way of doing things.

Well, many in the microcomputer world agree with you and that's why there's a burgeoning number of input devices on the market, all aimed at making life easier. There's the mouse; the digitizing tablet; the bar code reader, and light pen. All of these give you an alternative input method. The keyboard, considered by many to be THE input device for a microcomputer isn't the only one, nor is it the best.

Many times, one of the alternative devices will work equally well and, more efficiently. In an environment which requires vast amounts of information input, an optical character reader may be the best device, followed by a bar code reader or light pen. Or, let's take a manufacturing environment. In this type of atmosphere, a keyboard would prove more of a hindrance than a help. Or, in a situation where a system merely wants to know your choices, so the work, a simple mousepointing device may be the answer.

In all of this, there is still another device, which, while it is complex, makes the use of a microcomputer simple, the touchscreen.

There's much more to touchscreen technology than this, but, in its simplest terms, this is all there is to it. To the user, everything appears very simple. All he has to do is press an area on the screen to access a function and the computer does the rest.

Underlying this, of course, is a program and complicated input and output routines which take the simple pointing action and turn it into the action you have chosen with your pointing finger. It's all completely natural, the sort of thing that instinct tells you to do—you point.

Typical applications of touchscreen technology include microcomputer-based directories; automotive electronics—Buick Electra, for example; simple manufacturing inventory; computer-aided manufacturing environments, and the like, or any environment which doesn't require keyboard input or a keyboard would be inappropriate. (See Fig. 1)

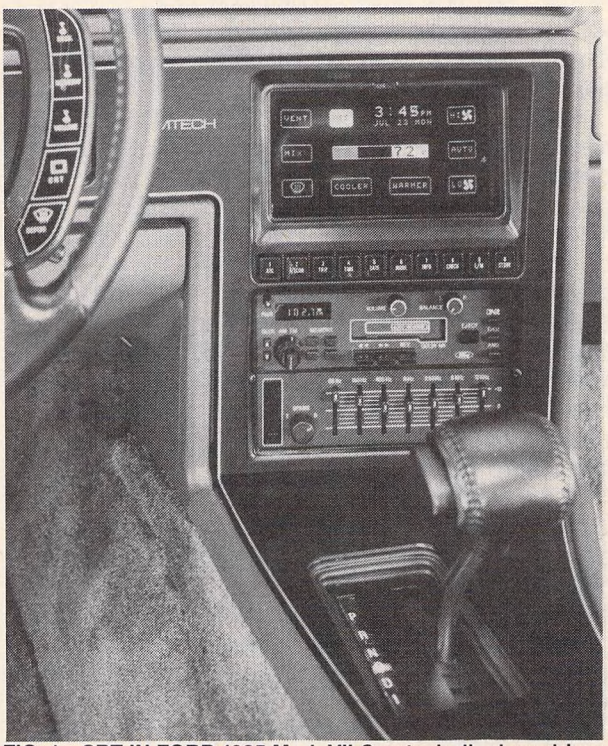


FIG. 1—CRT IN FORD 1985 Mark VII Comtech displays driver information and permits manipulation of such items as climate control simply by touching the screen.

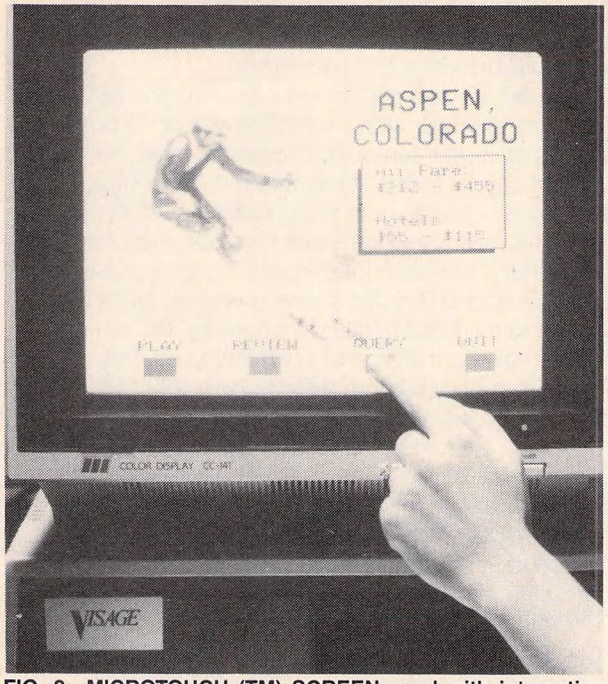


FIG. 2—MICROTOUCH (TM) SCREEN used with interactive videodisc system from Visage, Inc. for point-of-application where users can select vacation travel arrangements.

Three technologies

At the moment, there are three types of touchscreen technology.

The first is the traditional resistive, plastic-type; the second and newest is the resistive-capacitive glass-type, and the third, based on a different technology, is the light emitting diode-type.

The newest expression of touchscreen technology is offered by MicroTouch Systems Inc. of Woburn, MA. (See Fig. 2.) This company has come out with a touchscreen which eliminates many of the problems associated with plastic touch-sensitive screens.

For example, traditional plastic touchscreens are prone to damage from sharp objects, such as pens or pointing stylii and they cut down on the optical quality of a computer's video display. Further, the sandwich of plastic overlays and mechanical dots used in traditional touchscreens also degrades a display image.

The MicroTouch screen employs a solid glass sensor and bonded overlay to handle its functions. This type, since it is more impervious to damage, offers greater long-term reliability than traditional technology.

A plastic-based touchscreen system is actually a sandwich system.

Usually employing two or more sheets of plastic and a center electromechanical sheet covered with dots, the plastic-based system uses those dots to represent information to a touchscreen controller. Changes in the resistance of the middle layer indicate positional information. That controller, in turn, takes the information which has been generated by a user's touch and turns it into digital information for use with a driver program in the microcomputer's memory. In turn, the driver program interprets the touch to mean an action and the microcomputer supplies the solution.

If you look at a traditional touchscreen system, you will see the plastic overlay is linked with the microcomputer either through a parallel or serial port. In those cases where the system is built into a microcomputer, the touchscreen occupies the spot of a logical device in the microcomputer's memory. This means that although the device may not actually be present physically, the microcomputer thinks it is there and accepts its input.

The linkage between the touchscreen and its controller is handled via a bus which is connected to the dot screen that is sandwiched between the two plastic layers. Those layers are coated with an electrically conductive material and make contact with the center dot layer. The changes in electrical resistance that are generated when contact is made determine the input for the controller in the system.

The touchscreen's bus operates on the X-Y axis of the screen and positional inputs are determined in this manner. The contacts at the vertical sides of the screen act as the X-axis, while the contacts along the horizontal act as the Y-axis.

One drawback of this type of touchscreen system is that it is rather coarse in its positional inputs. Since the plastic is very flexible, when a user touches a certain area of the screen many X-Y positional inputs are generated at once. This mass of information is sent along the signal bus to the controller, which determines the action to be taken. Since so many dots are accessed during a touch, you can see it is impossible to have the system act in any more than a broad manner. Unless the driver program changes to a new, more finely tuned function, the touchscreen is incapable of rendering finely tuned input.

Another solution

A more durable solution to the plastic membrane is an LED touchscreen. Again, this system depends on an X-Y axis arrangement, but, instead of using a plastic membrane and electromechanical dots, it uses a rim of LEDs and detectors on the perimeter of the video display tube.

This has the advantage of not detracting from the optical clarity of a display device, but, like the plastic-based touchscreen, it is incapable of high resolution, due to size constraints. No matter how small the LED is, it and its array is still large in comparison to the video display screen and its positional inputs are very broad.

For example, let's say you break three LEDs vertically and four horizontally with your finger. That is a fairly broad area, using even mini-LEDs. So, you can see that resolution is low and, unless the driver program is ready with multiple screens and new choices, then the functionality of this type of technology is limited.

It is an interesting technology itself, though.

To picture an LED-driven touchscreen system, think of the screen of a microcomputer itself. Surrounding the screen, and raised slightly above it, is a bezel containing the ring of LEDs and detectors. Connected to the back of the bezel is the LED system's signal bus, which interacts with the touchscreen controller. That controller can either be in the CRT housing or within the system box. It takes the rough digital positional inputs and sends them on to the microprocessor for

processing. Usually, the controller is an intelligent signal processor, which, like the processor in a plastic-membrane system, may either be recognized as a logical parallel or serial port.

In action, the LEDs emit a crisscross grid of infrared beams over the surface of the display tube and merely breaking the beams causes the positional input to register in the controller.

The problem with the LED touchscreen is not only its basic coarseness, but also the fact that the IR beams are suspended a distance above the highest point on the surface of the curving CRT screen. This can translate to parallax problems for the system. The signal processor must have error correcting capability and this increases its complexity. One advantage to this system is that its digitization is almost instantaneous. Since the IR beam is either continuous or broken (on or off), its inputs are digital and this can eliminate a layer of conversion (analog to digital) since the voltage is on or off.

A new technology

Representing the newest resistive touchscreen technology is that developed by MicroTouch. This technology has certain inherent features that make it more reliable that older forms. For example, since it doesn't rely on plastic membranes, its durability factor is higher, which is important in a heavy use environment. It provides the microcomputer user with greater display clarity. And, since it is part of the touchscreen, no parallax problem.

The key to this system—and systems like it—is a solid glass sensor. It features a solid glass overlay with a resistive coating bonded to its surface. The key to this system is capacitive coupling between the object used for pointing and the surface. This coupling changes the resistive qualities of the glass and information is generated. (See Fig. 2.)

Almost immediately, you can see the advantages of this system. However, it has some advantages which aren't that apparent, such as high-resolution capability. With this type of system, a CRT now has 256 by 256 or 65,536 touch points. With this type of resolution, it should be possible to increase the information content of a program screen and also make the driver program far more efficient for the user. Instead of having to page through screen after screen of material, most of the choices are presented on one screen.

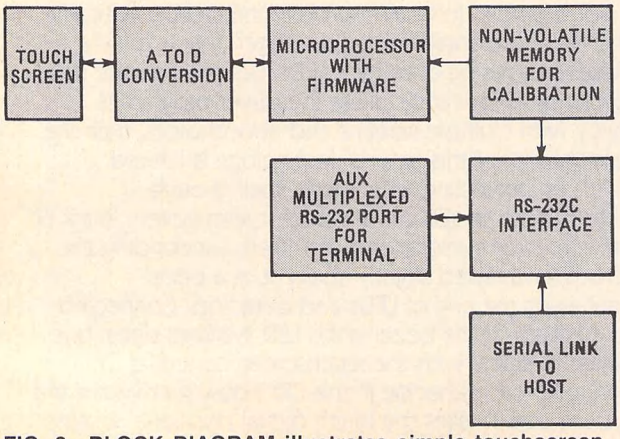


FIG. 3—BLOCK DIAGRAM illustrates simple touchscreen system.

This system is also capable of nearly instant reaction to multiple touches. With a sampling rate of 50 points per second, a user can make choices far more quickly than with other systems. It can transmit touch data in either a stream mode or in a one point per touch, point mode. This means you can have some detailed screens of information available for the user. Typically, plastic membrane and LED systems have lower sampling rates and are more limited in their functionality. The sampling rate does rely on the type of controller used, but, you will find most touchscreen systems have a 10 to 30 point per second sampling rate.

Driven by a microprocessor, this type of system also is system-independent. It uses an RS-232 serial link to communicate with the microprocessor in a system unit and is capable of operating over a range of 110 to 9,600 baud. It provides a multiplexed, auxiliary RS-232 port for a terminal. (See Fig. 3)

The microprocessor handles several functions. Since the signals generated by a touch on the screen are actually changes in electrical voltage, they are analog in nature and must be converted to digital form before they can be used by the touchscreen's controller. The touchscreen's intelligent controller performs the analog-to-digital conversion and then sends those signals to the controller. The controller, typically an 8-bit microprocessor, has four Read-Only Memory (ROM) based commands, including mode, which permits the user to select the point, stream or inactive mode (no touch data transmitted so a CRT can be used normally); calibration, which aligns the touchscreen with the CRT; data format, which allows the selection of decimal, hexadecimal or binary data representations; resent, which returns the controller to the stream mode and decimal format, clears the output buffer, and runs a diagnostic, and command-point, which is available for the creation and management of special touch zones on the screen.

Since this type of touchscreen is system independent, it also includes programming capability to handle the needs of various microcomputer systems. Different data formats and calibrations can be programmed and stored in an electrically erasable programmable read-only memory.

A breakthrough

Until now, touchscreens have generally lacked the definition and durability to make them effective in many environments. Since their resolution was low, they needed copious software to handle their tasks and this constant need to refer to new screens of information slowed down efficiency. With a system such as the new high-resolution ones now appearing on the market, this has changed and the user can have one screen handle many functions, which speeds efficiency. And, since the coating is bonded to the glass in new systems, it means durability should be very high. It represents a breakthrough which will make touchscreens a very real alternative input technology.◀CD▶

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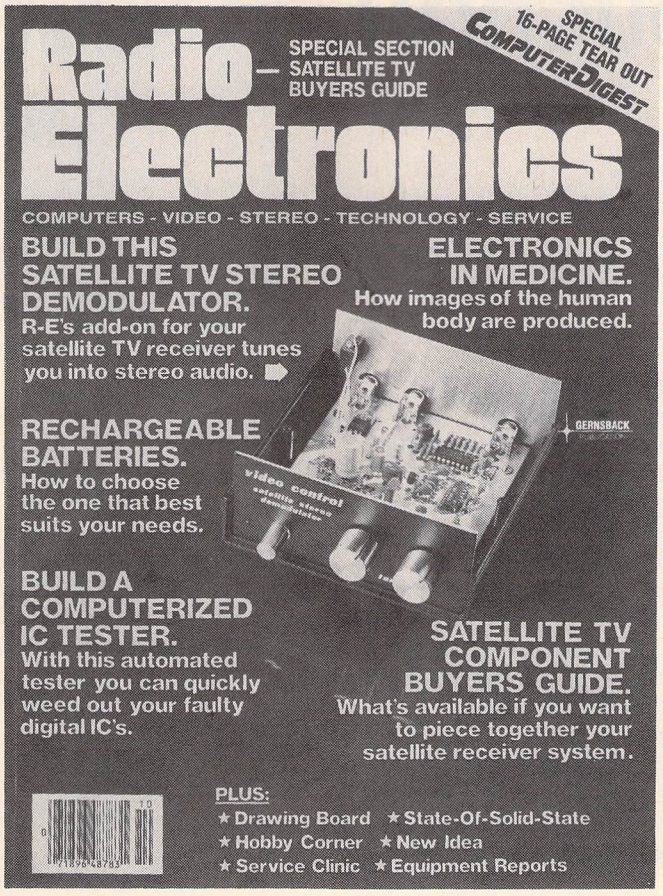
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VOICE REPRODUCTION

More than 5 seconds of speech with 16K.

JASON M. KINSER

■Timex-Sinclair users may have experienced the same feeling. My brother and I were discussing our computers. He owns a Commodore 64 and I have the Sinclair. He laughed because his computer could do "real" things. He had hi-res, and sound, and color.

Interfacing

The Sinclair has no speaker but it does have the two cassette interfaces.

An operational amplifier with a speaker connected to the mic-jack interface of the computer will serve as the speaker. Likewise, a microphone with an amplifier can be connected to the ear-jack interface to act as a microphone. The connecting cables are provided.

The cassette interfaces are tied directly with the TV and somewhat directly to the data bus. Being connected to the TV elimininates the need for one of the amplifiers. (See Fig. 1.)

Since the data bus, cassette interfaces, and the TV are all tied together all of the following programs must be run in the FAST mode. The SLOW mode will keep the display running and this will drown out anything.

Noise from nowhere

The first task of voice synthesis is to have the computer produce simple frequencies. These frequencies are single-amplitude square waves. Voice reproduction will be just differing frequencies.

Access to the mic-jack (output) or the TV speaker is handled by the machine language command OUT (n),A. This command takes the contents of the Accumulator and dumps them onto the data bus. The contents are then sent to device number "n."

There are 256 device numbers. The ear-jack is FE and the mic-jack is FF. Therefore, OUT (FF), A is used.

This will output one pulse. The signal coming out of the machine will oscillate according to the bit pattern of the Accumulator. These oscillations are too fast to produce an audible tone. They are, however, used to change the flavor of the produced tones.

The frequencies are determined by the amount of time between the output of the Accumulator. This can be set by the programmer. The following program will produce simple frequencies depending on what is in register B. This holds the length of the wait before the

All photos by Bruce Wittenmyer

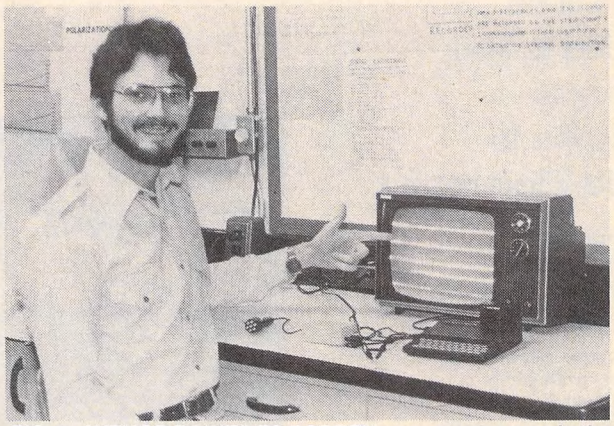

FIG. 1--AUTHOR POINTS TO SCREEN as computer runs in the "speaking" mode. TV lines flicker according to outputted sound.

Accumulator is sent on to the bus.

The Accumulator will be accessed until BREAK is pressed. CALL 0F46 is the subroutine which will recognize BREAK. If it is pressed it will return from the subroutine with the Carry low.

The Accumulator can hold any number. Also the screen will display the noise being produced along with the bit pattern of the Accumulator.

```
LD A, FF        3E FF
OUT (FF), A     D3 FF
LD B, 66        06 66
CALL 0F46       CD 46 0F
RET NC          D0
DJNZ FA         10 FA
JR              18 F2
```

The voice reproduction will consist of inputting a voice and having the computer reproduce it.

The input into the machine must be done through the cassette interface (see Fig. 2). If a microphone with an amplifier is not available, then record the voice and play the recording into the computer. It is more work, but better than nothing. (See Fig. 3.)

Inputting is similar to outputting. Instead of OUT (n), A the comparable IN A, (n) is used. When using the ear-jack IN A, (FE) is used.

Unfortunately, the input does not record all of the information. It only sees a threshold. So, the incoming signal is recorded as high if the signal is above the threshold, and low if it is not. The machine will not see

FIG. 2—THE COMPUTER with audio amplifier and mike connected to cassette interfaces. The program seen on the screen is a representation of the machine code program.

FIG. 3—MICROPHONE IS CONNECTED TO AMPLIFIER which enters the ear-jack of the computer. Mic-jack is unconnected but will connect to another amplifier and speaker.

how far above or below the signal is.

The accumulator will have either 39 or B9. The only bit that makes any difference is bit number 7. (Sometimes the lowest bit alters, but this is independent of the incoming signal.) The highest bit is rolled off and saved in succession.

The bad news is that the wave cannot be stored completely. Only the frequency is stored. The amplitude is lost. Voice reproduction is still possible though. Some clearness will be foregone.

The good news is that now each byte can hold eight different samplings of the signal. This increases the amount of speech time by a factor of eight. This allows for almost six seconds of speech. Generally, a 64 K machine would allow only 2.5 seconds of speech.

The only remaining problem is to find someplace to store the data. The data can be stored in a RAM statement, but you first have to make a REM statement 13,000 characters long. The data could be stored in a string, but these

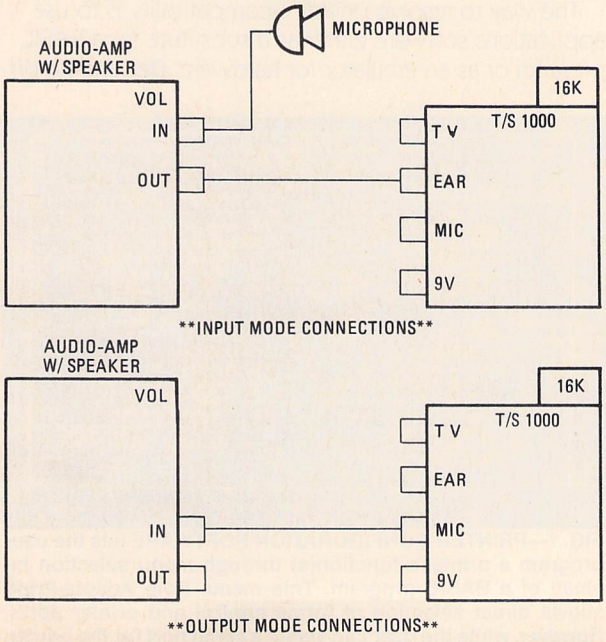

FIG. 4—BLOCK DIAGRAMS reveal input and output mode connections.

are easy to erase and move around in the memory. The data could be put above the RAMTOP, but this cannot be saved on tape. For this demonstration, the data will be put above the RAMTOP.

First move the RAMTOP down.

```
POKE 16389, 77
POKE 16388, 56
```

The first location for data storing is 19768. There are 13,000 bytes afterwards set aside for storage.

The following program will load the data. It is best to put the program in a REM statement. Enter the first basic command as a REM statement with at least 71 spaces following. That will make the first available position for the start of this program 16514.

```
LD HL, 4D38     21 38 4D
LD C, 32        OE 32
LD B, FF        O6 FF
LD D, 08        16 O8
IN A, (FE)      DB FE
RL A            CB 17
RL E            CB 13
CALL OF46       CD 46 OF
RET NC          DO
DEC D           15
JR NZ, F3       20 F3
LD (HL), E      73
INC HL          23
DEC B           05
JR NZ, EC       20 EC
DEC C           OD
JR NZ, E9       20 E9
RET             C9
```

Reproducing the signal is as simple as putting it into the machine. The data will be accessed one bit at a time. If the bit is high then the contents of the Accumulator are put onto the data bus. If it is low, then that part of the program is bypassed.

The following program is the output. It will take the same data that the computer received and kick it back out. The program should also be put in the REM statement. It will start at 16545.

One section of the program may seem a bit useless.

```
LD B, 01
DJNZ FE
```

This is a wait of 1. It can be used to slow down the voice by loading B with another number. Inserting this into the first program can speed up the voice when it is replayed. There are still other uses of this routine that are still being explored. It does slightly slow down the reproduction, but it is not noticeable unless a pure tone is being compared by its reproduction.

Now it is ready. Run the first program and immediately input a voice. Next turn up the TV speaker or turn on the external speaker and run the second program. (See Fig. 4)

What will be heard are the frequencies of the original voice. It will be slightly rough. Remember, the TV will add some fuzziness to the voice. The best response is outputted through the mic-jack.

Now my brother is down to only one laugh. He can no longer laugh about hi-res or his sound any longer. Of course, he still laughs about the the color that his computer produces, but he who laughs last...◀CD▶

EMULATING PRINTERS

Resolving some incompatibility problems

HERB FRIEDMAN

■The difficulty with anything as dynamic as personal computing is that perfectly suitable and costly equipment can become obsolete and unusable. This is particularly true of printers, whose functions, features and characteristics are rapidly outstripped by the level of technical competence expected of the user, and by new hardware and software. For example, although the conventional 80-column printer is more than adequate for most of the typical office routines, commercially prepared spreadsheets intended for business use have become so large and complex that an 80 character line barely conveys the desired information. Many of the latest spreadsheets require a 130 column line, or sidewise printing for an endless number of columns per line of printing.

While most matrix printers can be programmed to print "mice type"—meaning 16 to 18 characters per inch, which produces at least 132 characters per line on 8-1/2 inch wide paper—virtually all printer manuals assume the user has some level of competence as a BASIC programmer and can write a short program routine to configure the printer for "mice type." The BASIC program is necessary because few application programs have a direct way to send the printer control codes used to configure the printer. Configuration via the printer's control codes must be done through a BASIC program.

In the early days of personal computing most users had a working knowledge of BASIC, today, more often than not a personal computer is a business tool, and few users have any idea what programming or BASIC is about: Telling a user to write a short BASIC program for a printer is confusing and unproductive.

None of the older printers and almost none of the new non-IBM printers are 100% compatible with the characters produced in IBM computers by ASCII codes higher than 127, yet the IBM PCs and their clones are the standard of reference computer for the small businessman. Although a few of the latest non-IBM printers can reproduce from some to most of the IBM PC's graphic and foreign symbols, at the time this article was prepared none reproduced all characters provided by IBM compatible computers. It gets sort of sticky when you run a commercial applications program that is supposed to print a musical symbol, or even the omega symbol for resistance, and all your printer turns out is a blank space or characters bearing no relationship to what is seen on the screen.

The printer's computer.

The major reasons for the character incompatibility of specific matrix printers and computers are: (1) Manufacturers attempt to marry the consumer to a particular line of hardware; (2) matrix characters are generated by a computer built into the printer itself, and it is this computer which responds differently to ASCII input signals: The very same ASCII codes that cause one kind of printer to generate graphic lines will cause another printer to generate itallic or conventional characters. Actually, reasons 1 and 2 are interlocked because a manufacturer of a complete line of computer equipment can easily modify his software to work properly only with his particular line of printers and vice versa.

Software for hardware

The way to resolve printer incompatibility is to use applications software either as a substitute for a BASIC program or as an emulator for hardware. Depending on

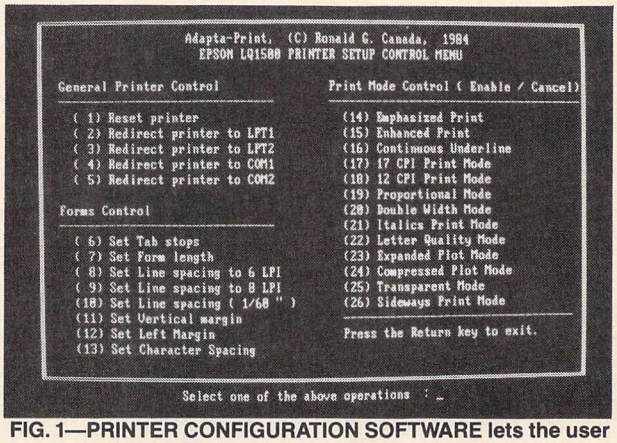
Adapta-Print, (C) Ronald G. Canada, 1984
EPSON LQ1500 PRINTER SETUP CONTROL MENU
General Printer Control
(1) Reset printer
(2) Redirect printer to LPT1
(3) Redirect printer to LPT2
(4) Redirect printer to COM1
(5) Redirect printer to COM2
Forms Control
(6) Set Tab stops
(7) Set Form length
(8) Set Line spacing to 6 LPI
(9) Set Line spacing to 8 LPI
(10) Set Line spacing (1/60 ")
(11) Set Vertical margin
(12) Set Left Margin
(13) Set Character Spacing
Print Mode Control (Enable / Cancel)
(14) Emphasized Print
(15) Enhanced Print
(16) Continuous Underline
(17) 17 CPI Print Mode
(18) 12 CPI Print Mode
(19) Proportional Mode
(20) Double Width Mode
(21) Italics Print Mode
(22) Letter Quality Mode
(23) Expanded Plot Mode
(24) Compressed Plot Mode
(25) Transparent Mode
(26) Sideways Print Mode
Press the Return key to exit.
Select one of the above operations :

FIG. 1—PRINTER CONFIGURATION SOFTWARE lets the user program a printer's function(s) through menu selection instead of a BASIC program. This menu, from Adapta-Print, allows direct selection of forms control and printer ports. However, while the user can select a serial port for the printer, the port had to be previously configured for serial parameters through the DOS MODE command.

your particular printer there are three ways this can accomplished.

First, we have the substitute for a BASIC program. Virtually all printer manuals show a few samples of BASIC programs that might be used to send the control codes which configure a matrix printer for some unusual font, such as double width characters, "mice type," itallics, or enhanced characters (correspondence quality). Aside from needing a working knowledge of both printer control codes and BASIC programming, using BASIC for configuration becomes unwieldy if it handles all possible printer functions, and there often isn't enough space on a disk to hold BASIC, the printer configuration program, and the applications software.

The best way to handle control code programming is to avoid the whole thing with printer configuration software, a special program that is generally booted through a batch file so the first thing the user does is configure the printer.

A particular advantage of independent configuration software (compared to a simple BASIC program) is that the software can automatically translate control codes so the correct one is sent to the printer when the user makes a menu selection. For example, the Epson, Okidata and Hewlett Packard printers employ different control codes for emphasized printing. If you were doing your own configuration through a BASIC program you would have to keep track of the correct codes for the various printers. This isn't true if you use a printer package such as Adapta-Print (Computational Systems, Inc., One Energy Center, Pellissippi Parkway, Knoxville, TN 37922), which provides printer configuration from the menu shown in Figure 1.

Adapta-Print is initially configured through an installation program for the printer control codes of a particular kind of printer. The installation provides automatic translation of a menu-selected feature into the proper printer codes for a specific printer. If the user selects *emphasized* printing, the program generates the correct control code for the installed printer. Typical of most printer configuration software, Adapta-Print permits stacking of control codes. As instructed by the menu, a user might enter a 20 for Double Width printing, then a 14 which would provide emphasized double width printing, and fnally a 15, which would produce "near letter quality" double-width characters. (Actually, the menu selections can be entered in any order).

Creating characters

The second level of printer configuration software creates characters which are beyond the normal capability of the printer. While virtually all printer manufacturers provide some graphic symbols in response to ASCII codes above 127, there is no standard set of graphic characters: Printer A doesn't produce the same characters as printer B in response to ASCII codes higher than 127. Although many printer manufacturers go their own way because there is no *official* standard for the graphic codes, IBM has set a defacto standard for graphic characters, and much commercial software utilizes the IBM graphics set.

Unless your printer is 100% compatible with the IBM graphics characters—and few are even partially compatible—what you get from a printer is not what you see on the screen. Many of the most popular printers print the horizontal and vertical lines, and the math and foreign characters of an IBM-compatible screen display as itallic characters.

Short of replacing the printer, the way around this problem is printer software such as The DigiCon Print Package (Digital Concepts, Inc, Inc., P.O. Box 8345, Pittsburgh, PA 15218), which is intended for Epson and Epson-compatible printers. In addition to other printer control functions, the DigiCon package uses the printer's addressable dot printing feature to generate its own fonts (type styles) such as script, block, and conventional characters, all of which duplicate all 56 characters in IBM's Set 1 and Set 2 character sets.

As shown in Figure 2, a dump of each DigiCon character set is mapped so the user can instantly determine the decimal ASCII value for every IBM character; information that is necessary to easily incorporate the IBM graphics into programs and documents. The ASCII values are determined by locating the vertical (left side) and horizontal (top)

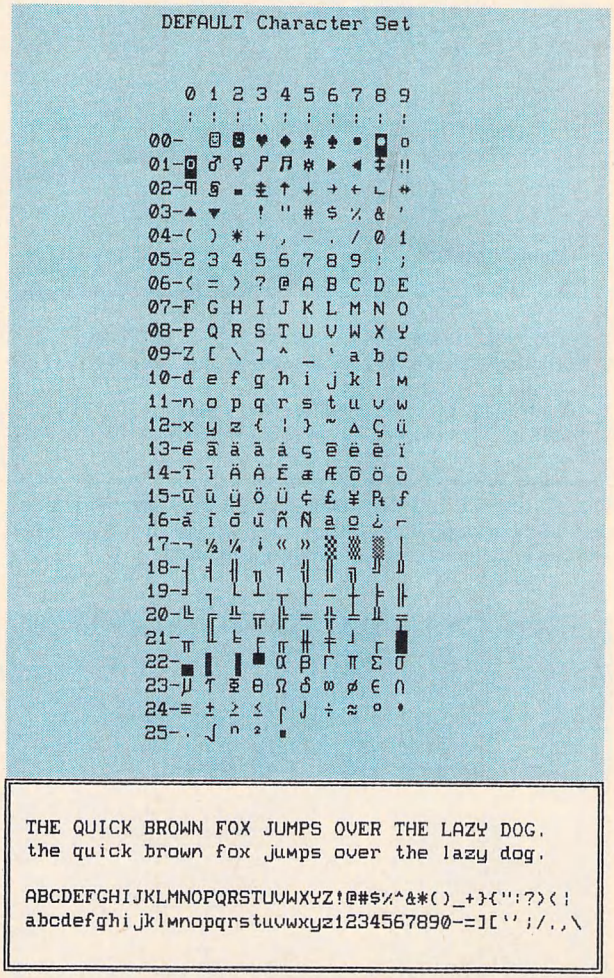
DEFAULT Character Set
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG.
the quick brown fox jumps over the lazy dog.
ABCDEFGHIJKLMNOPQRSTUVWXYZ!@#$%^&*()_+}{":?><|
abcdefghijklmnopqrstuvwxyz1234567890-=][';/.,\

FIG. 2a—THE DIGICON PRINT PACKAGE generates complete IBM graphics printer character sets. This one is for the default character set. The numbers along the left and top edge provide the ASCII code for each character. The omega symbol (used to indicate resistance) is ASCII 23 + 4, or ASCII 234.

values for a character. For example, the upper case A is ASCII 065 (or 65); the omega symbol used to represent "ohms" is 234, while the international symbols for male and female are respectively 011 (11) and 012 (12).

The characters are attained by printing through the DigiCon program, which means that the original file must be saved in ASCII. If you have a WordStar file it must be converted to ASCII (yes, it can be easily done), while a PFS:Write file can be saved directly in ASCII. The same is true for data files or anything else: they must be in ASCII in order to be processed properly by the DigiCon system. Screen dumps are unaffected by the conversion—they do not print what is seen in the screen—because the dump goes directly to the printer, bypassing the conversion software.

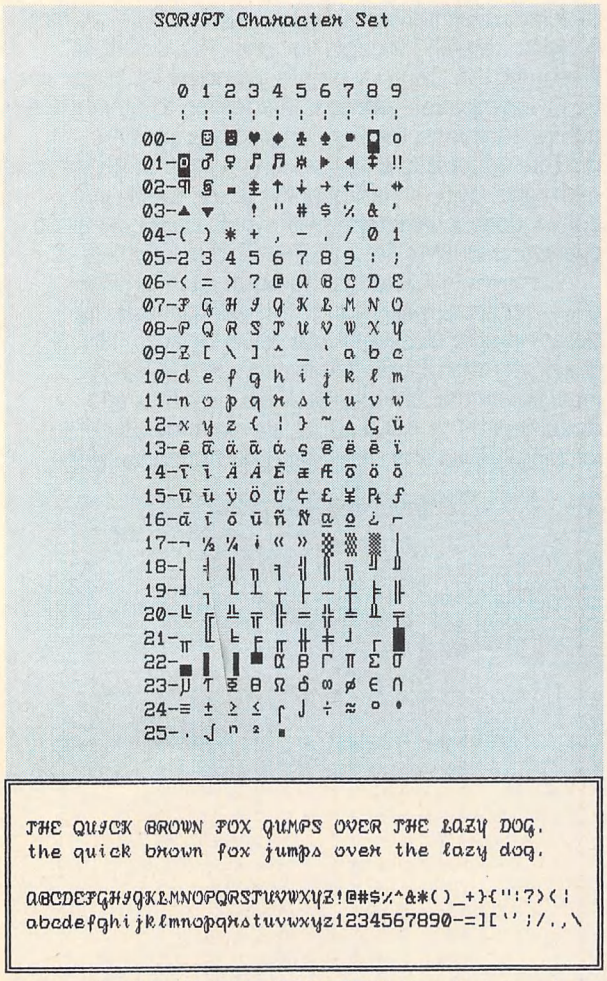
SCRIPT Character Set
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG.
the quick brown fox jumps over the lazy dog.
ABCDEFGHIJKLMNOPQRSTUVWXYZ!@#$%^&*()_+}{":?><|
abcdefghijklmnopqrstuvwxyz1234567890-=][';/.,\

FIG. 2b—SINCE DIGICON GENERATES the characters independently through dot-addressable graphics, it can generate various type faces, such as this "script" font.

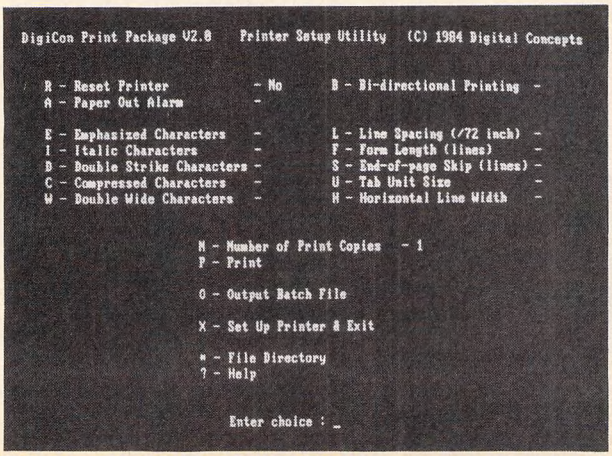
DigiCon Print Package V2.0 Printer Setup Utility (C) 1984 Digital Concepts
R - Reset Printer - No
A - Paper Out Alarm -
B - Bi-directional Printing -
E - Emphasized Characters -
I - Italic Characters -
D - Double Strike Characters -
C - Compressed Characters -
W - Double Wide Characters -
L - Line Spacing (/72 inch) -
F - Form Length (lines) -
S - End-of-page Skip (lines) -
U - Tab Unit Size -
H - Horizontal Line Width -
N - Number of Print Copies - 1
P - Print
O - Output Batch File
X - Set Up Printer & Exit
* - File Directory
? - Help
Enter choice : _

FIG. 2c—DIGICON'S CONVENTIONAL printer control functions are determined through menu selection.

Load your own

The most convenient way to accommodate the IBM graphic characters—which is arranged in two *Sets*—is by programming the printer to recognize and generate the characters directly from conventional software. Low cost programmable printers like the Epson FX+ series are a recent concept for personal computing. The FX+ has its own character set in ROM as well as RAM, which can be user configured with a user-designed font. A program such as the Printer BOSS (Connecticut Software Systems Corp., 30 Wilson Ave., Rowayton, CT 06853), which offers conventional control code configuration for Epson printers, can also program an FX+ printer to recognize and print IBM's graphic character sets. The printer can respond directly to the orginal applications software without the need for an intermediate ASCII-only print mode. Figure 3 shows the large menu selection screen of the Printer BOSS, which permits the user to program both the printer control codes and the character font at the same time.

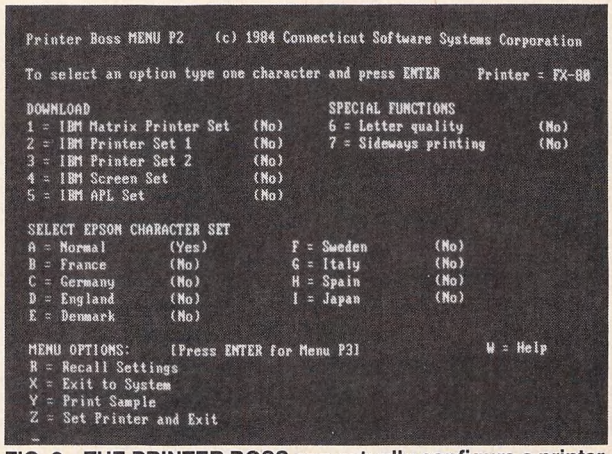
Printer Boss MENU P2 (c) 1984 Connecticut Software Systems Corporation
To select an option type one character and press ENTER Printer = FX-80
DOWNLOAD
1 = IBM Matrix Printer Set (No)
2 = IBM Printer Set 1 (No)
3 = IBM Printer Set 2 (No)
4 = IBM Screen Set (No)
5 = IBM APL Set (No)
SPECIAL FUNCTIONS
6 = Letter quality (No)
7 = Sideways printing (No)
SELECT EPSON CHARACTER SET
A = Normal (Yes)
B = France (No)
C = Germany (No)
D = England (No)
E = Denmark (No)
F = Sweden (No)
G = Italy (No)
H = Spain (No)
I = Japan (No)
MENU OPTIONS: [Press ENTER for Menu P3] W = Help
R = Recall Settings
X = Exit to System
Y = Print Sample
Z = Set Printer and Exit

FIG. 3—THE PRINTER BOSS can actually configure a printer so the printer itself "thinks" it's IBM compatible. It does this by downloading a character set(s) into the printer's memory. The only limitation to this method is that it is presently available only for the Epson FX printer series.

A programmed font is the ultimate emulation because the printer itself functions as conventional hardware, meaning that it does not require intermediate translation software. Even screen dumps will produce the accurate hardcopy of the screen display.

Because of the pervasive influence of IBM most printers will reproduce the complete IBM character and graphics set(s). Until then, or until you're ready to purchase a new printer, the best way to generate unconventional type styles and characters is to use software that emulates hardware.◀Ω▶